nervous system of animals; and the transmission of the stimulus has commonly been referred either to a serially altered condition of the protoplasm in its relation to water, or to vague suggestions arising from the well-known facts of protoplasmic continuity between adjacent cells, the onus of transmission being cast on the protoplasm as a whole.

Dr. Němec, however, contends that these notions demand reconsideration, and he gives an account in the book before us of observations which, if confirmed by subsequent examination, are of great importance as enabling us to obtain a more definite comprehension of the relations existing between perception and reaction in the motile organs of plants.

The author begins by studying the effects on the protoplasm of wounding the sensitive regions of roots and other organs, and, in the main, he confirms, and at the same time extends, the conclusions arrived at by Tangl some years ago. He distinguishes two traumatic phases as consequent on such an operation. The first, or *primary*, response consists in an aggregation of the protoplasm, and it may be of the nucleus also, to the woundward end of the cell. This effect is propagated with diminishing rapidity in a direction away from the wound, and at a rate which is not equal for the different tissues composing the organ. A curious fact relating to the travelling onward of the effect is brought to light in connection with cells in which nuclear division is proceeding, for the disturbance appears to miss these cells, though it reappears immediately beyond them. Shortly after this primary manifestation has passed over a cell, recovery supervenes, only, however, to give place to a *secondary* phenomenon. The protoplasm of the cells in the vicinity of the wound assumes a more or less gelatinous character, and the vacuoles begin to undergo fusion. This secondary effect is, however, apparently rather local, and travels neither so far nor so fast as does the primary one. It may perhaps be questioned whether the latter is not, at least mainly, due to a disturbance of hydrostatic equilibrium in the cells consequent on the lesion of the organ, whilst the secondary change may possibly be associated with the febrile condition known to be induced by mechanical and other injuries. Further investigation of the phenomena by means, *e.g.*, of plasmolysing reagents might prove of interest.

Of more general importance than these results is the statement that the author has succeeded, by means of appropriate stains, in demonstrating a continuous fibrillar structure in the cytoplasm. These fibrillæ, which are figured as somewhat thick cords, traverse the cell chiefly in the longitudinal direction; and, although the point was not definitely settled, they appeared to connect with similar ones in the contiguous cells of a longitudinal series. They are not equally present in every kind of tissue, sometimes they occur in the cortex whilst in other cases they are most abundant in the plerome. They are almost always met with in sensitive and motile organs, to which also they appear to be almost exclusively confined, and Nemec believes that they represent the means whereby stimuli are rendered transmissible. He finds that conditions which impair or abolish such transmission also affect the fibrillar structure. The latter may, indeed, be temporarily or permanently disorganised, and so long as this is the case the organ appears to be insensitive.

Němec himself considers some of the objections which may be urged against his view of the functions of the fibrils. Thus it might be argued that the same causes which result in a dislocation of the sensitive mechanism of an organ may also, and concomitantly, destroy the normal structural configuration of the protoplasm, but that it does not therefore follow that the two should necessarily stand in any causal connection with each other. The force of such an objection is, however, weakened by two observations made on roots. In *Vicia*, the fibrils are restricted to the axile cylinder (plerome) of the root. Now if the cortex be severed by an annular cut, after the disturbance which ensues as the result of the injury has passed away, the organ recovers the power of perceiving and transmitting stimuli; if, however, the plerome be cut through, by means of a needle, then the power of future response in the case of stimuli affecting the distal end will be found to have been finally lost. Again, it is known that the perception, by roots, of the stimulus given by gravity is limited to the actual growing point, whilst the motile region, in which the stimulus provokes a visible result, is situated at some distance behind it. If the tip of the root be cut away, the power of further response to the gravity-stimulus is thenceforth in abeyance pending the regeneration of the apex. Now in some instances it was observed that the power of response to the stimulus was not recovered even after the formation of the new growing point, but in every one of these cases further examination showed that the fibrillar continuity had not been properly restored. Hence the path of transmission between the percipient apex and the executive motile portion of the root still remained interrupted.

It is clear that Dr. Němec has opened up a promising field of investigation, and one which is no less important from the point of view of the plant world than from that of the lower animal organisms in which also no permanent nervous system is present. It is to be hoped that the observations may be thoroughly tested by physiological as well as by histological methods, a task which should be rendered the easier inasmuch as the structures can apparently be identified in the still living cells.

J. B. F.

AMERICAN AGRICULTURAL RESEARCHES.

Yearbook of the United States Department of Agriculture, 1900. Pp. 888. (Washington, D.C., 1901.)

THE bulky volume before us is as full of interest as its predecessors, and as profusely illustrated. Its contents are extremely various, for, as mentioned in the preface, there is not a single bureau, division or office of the Department that has not contributed to the present book. The reports occupy 633 pages. These are followed by an appendix of 231 pages, in which a great deal of statistical and miscellaneous information is brought together for the use of the farming community. We can only refer to a very few of the subjects discussed.

The report on the cultivation of Smyrna figs in California is full of interest of many kinds. For this fig to be brought to perfection, it is necessary that the

flower should be fertilised by pollen from the wild fig, or caprifig. The pollen is conveyed by an insect, *Blastophaga grossorum*, which goes through its various stages of growth in the wild fig. It is the practice in Smyrna and other fig-growing countries to break off the fruits of the caprifig, and tie them to the limbs of the edible fig tree, at the time when the flower receptacles of the latter are in a suitable condition. The result is the production of figs far larger and finer than would be obtained without this operation. The American report gives a brief history of our knowledge on this subject, and a detailed account of the introduction of the Smyrna fig into California, the subsequent introduction of the caprifig, and the final successful introduction, after several failures of the insect, with details of the work done during the season of 1899, when the first crop of figs fully equal to the imported article was obtained. For the successful fertilisation of the Smyrna fig it is necessary that the caprifig should blossom at the same time as the Smyrna fig, and that the winged female insect should also at the same time be emerging from the galls containing the pupa. These adjustments are liable to be disturbed by variations in climate and season, and require careful study and skilled scientific superintendence if fig culture is to be successfully introduced into a new country.

The report on the cultivation of the date palm is also of great interest. A full account is given of the conditions under which the finest dates are produced in Algeria and the Sahara, and of the steps which have been taken to introduce the best varieties of the date palm into Arizona and other suitable climates in the United States. It is shown that the best varieties can only be introduced by means of offshoots, the plants grown from seed being very various in character. Different climates require the choice of different varieties. The tree has the great merit of flourishing in climates in which the summer is too hot and too dry to permit of ordinary cultivation ; it flourishes even in soils impregnated with alkali salts, a condition frequently met with in dry climates. The report should be of considerable value to the Agricultural Department of our Indian Empire, where vast areas of waste alkali land are still waiting to be dealt with.

There is one more report, of special interest in connection with the present summer, of which we will briefly speak : its subject is hot waves, the conditions which produce them and their effect on agriculture. The continent of North America is at present admirably suited for the study of meteorological phenomena , the observers cover an immense area, and are all in telegraphic communication with the Central Weather Bureau at Washington. The report in question includes the study of three remarkable periods of heat, and is illustrated by maps showing the distribution of pressure and temperature over the continent during these periods. The first point that strikes one is the unsuitableness of the phrase "hot wave." The heat periods are, indeed, periods of stagnation in the atmosphere. The conditions appear to be similar in each instance which is discussed. There is an area of moderately high pressure in the subtropical region towards the south-east ; an area of moderately low pressure in the northern central States, and a second area of high pressure on the west or north-west coast. These conditions are steadily maintained during the hot period. There is, of course, a slow flow of air from the subtropical, south-eastern area of high pressure to the central or north-central area of low pressure. The extreme temperatures occur between these two regions. The great heat is not simply due to air coming from a warm region ; it is largely due to the clear sky affording full opportunity for the receipt of solar energy, and to the small radiation during the night from the earth's surface ; the hot nights are, indeed, a striking feature of these periods. What is the cause of this absence of night radiation with an apparently clear sky? It appears to be due to the presence of a large quantity of transparent water vapour in the higher regions of the atmosphere, which allows the passage of solar radiation but forbids the return of the lower grade heat waves of terrestrial radiation.

R. WARINGTON.

SCHOOL HYGIENE.

School Hygiene. By Edward Shaw, Professor of the Institutes of Pedagogy, New York University. Pp. 260. (London : Macmillan and Co., Ltd., 1901.) 4*s.* 6*d.* net.

A Manual of School Hygiene. By E. W. Hope, M.D., Professor of Hygiene, University College, Liverpool, and E. A. Browne, F.R.C.S.E., Lecturer of Ophthalmology, University College, Liverpool. Pp. 207. (Cambridge : University Press, 1901.) 3*s.* 6*d.* net.

IT has been the aim of the authors of these two works to set forth the conditions which should surround school pupils in order that their mental and physical health may be promoted. No true education in mental training can overlook the hygienic and physical relationship of mind and body, and no knowledge must be conveyed at the expense of physical and moral development ; for it is true, as Mr. Herbert Spencer has reminded us, that the essential object of education is to teach us how to live happily. Moreover, the connection between physical health and the power of voluntary control and, consequently, of conduct, is very close, and perfect mental development cannot be brought about if the opportunity is not given for healthy physical development. Notwithstanding the general acceptance of these truisms, school buildings are still being erected with a view mainly to exterior effect, and an adequate system of ventilation in the crowded class-rooms is rarely to be met with. As Prof. Shaw has pointed out, the school-room should be the unit first to be considered in planning the school building, and the building should be a number of school-rooms properly disposed, and not a whole cut up into school-rooms whose size and arrangement are dependent upon the size and shape of the building.

The guiding principles of hygiene, so far as it is affected by the circumstances of school life, are well and clearly set forth in both books, and the essential facts of school health are brought within the easy reach of the parent or teacher. To do their duty in this respect, no great amount of detail knowledge is necessary, but rather one of general principles combined with an intelligent observation of children with the view of detecting